

Claims

- [c1] A heat exchanger for ceramic oxygen generating systems, fuel cells, or the like, having a heat generating furnace, comprising:
- at least one heat exchanging arm formed from an inner and an outer concentric tube and having an inner and outer passageway separated by a wall of the inner concentric tube;
 - the inner concentric tube having a first end with a fluid flow outlet for discharging an exhaust fluid and a second end with a fluid flow inlet for receiving an input of the exhaust fluid;
 - the outer concentric tube having a first end with a fluid flow inlet for receiving an input of an intake fluid flow and a second end with a fluid flow outlet for discharging the intake fluid;
 - the exhaust fluid flows through the inner concentric tube in a direction substantially opposite to the intake fluid flow through the heat exchanger arm; and,
 - the heat exchanging arm being adapted to be attached to an exterior portion of the furnace.
- [c2] The invention of claim [Claim Reference] wherein the inner and outer concentric tubes form rectangular channels.
- [c3] The invention of claim [Claim Reference] wherein:
- the inner concentric tube is formed from a first and a second sheet each having a first and a second edge;
 - the outer concentric tube is formed from a first and a second sheet each having a first and a second edge; and,
 - the first edges of the first and second sheets of the inner concentric tube and the first and second sheets of the outer concentric tube are crimped together, and the second edges of the first and second sheets of the inner concentric tube and the first and second sheets of the outer concentric tube are crimped together forming the channels.
- [c4] The invention of claim [Claim Reference] wherein the crimping of the sheets are in a direction substantially parallel to the fluid flow through the arm.

- [c5] The invention of claim [Claim Reference] wherein the heat exchanger has a plurality of arms with their respective second ends joined at a heat exchanger hub.
- [c6] The invention of claim [Claim Reference] wherein the heat exchanger hub has an exhaust fluid intake shared by the joined arms.
- [c7] The invention of claim [Claim Reference] wherein the heat exchanger has one or more U shaped arms having respective second ends adapted to be inserted directly into the furnace.
- [c8] An ceramic oxygen generating system comprising:
- a heat generating furnace for providing a heated environment to an internally mounted oxygen separator;
 - at least one heat exchanging arm formed from an inner and an outer concentric tube and having an inner and outer passageway separated by a wall of the inner concentric tube;
 - the inner concentric tube having a first end with a fluid flow outlet for discharging an exhaust fluid and a second end with a fluid flow inlet for receiving an input of the exhaust fluid;
 - the outer concentric tube having a first end with a fluid flow inlet for receiving an input of an intake fluid flow and a second end with a fluid flow outlet for discharging the intake fluid;
 - the exhaust fluid flows through the inner concentric tube in a direction substantially opposite to the intake fluid flow through the heat exchanger arm; and,
 - the heat exchanging arm being adapted to be attached to an exterior portion of the furnace.
- [c9] The invention of claim [Claim Reference] wherein the inner and outer concentric tubes form rectangular channels.
- [c10] The invention of claim [Claim Reference] wherein:
- the inner concentric tube is formed from a first and a second sheet each having a first and a second edge;

the outer concentric tube is formed from a first and a second sheet each having a first and a second edge; and,
the first edges of the first and second sheets of the inner concentric tube and the first and second sheets of the outer concentric tube are crimped together, and the second edges of the first and second sheets of the inner concentric tube and the first and second sheets of the outer concentric tube are crimped together forming the channels.

[c11] The invention of claim [Claim Reference] wherein the crimping of the sheets are in a direction substantially parallel to the fluid flow through the arm.

[c12] The invention of claim [Claim Reference] wherein the heat exchanger has a plurality of arms with their respective second ends joined at a heat exchanger hub.

[c13] The invention of claim [Claim Reference] wherein the heat exchanger hub has an exhaust fluid intake shared by the joined arms.

[c14] The invention of claim [Claim Reference] wherein the heat exchanger has one or more U shaped arms having respective second ends adapted to be inserted directly into the furnace.